

CLAIMS

1. A system for rendering a character for display in grayscale on a grayscale output device, comprising:

means for defining a coarse grid of cells, each coarse cell corresponding to an output device grayscale pixel, and a high-resolution grid of fine cells, the high-resolution grid being aligned with said coarse grid so that each coarse cell includes an integer number of undivided fine cells, the grids defining edges of the cells;

means for placing a character defined by a font program with reference to the coarse grid and fine grid, the character having a stem hinted with two parallel edges that are placed with reference to the grids when the character is so placed, the stem hint edges being separated by a stem width; and

stem aligner means for processing the stem before rendering the character font program for output on the output device, the stem aligner means comprising means for performing a black-edge hinted stem placement policy.

2. The system of claim 1, wherein:

the number of fine cells per coarse cell is determined according to the number of grayscale levels that can be produced by a pixel of the output device.

3. The system of claim 1, wherein:

the number of fine cells per coarse cell is determined by a single, client-selected grid ratio.

4. The system of claim 1, wherein:

the stem aligner means further comprises means for performing an unbiased-stems hinted stem placement policy.

5. The system of claim 4, wherein:

the means for performing a black-edge policy comprise:

means for rounding the stem width to the width of an integral number of fine cells; and

5 means for moving the stem with rounded width a minimum distance so that at least one of the stem hint edges aligns with a parallel coarse cell edge; and

the means for performing an unbiased-stems policy comprise:

means for rounding the stem width to the width of an integral number of fine cells;

10 means for determining a minimum number of coarse cells that can be spanned by the rounded width of the stem; and

means for determining whether the stem spans more than the minimum number of coarse cells and, if it does, for moving the stem a minimum distance so that at least one of the stem hint edges aligns with a parallel coarse cell edge.

15 6. A system for rendering a character for display in grayscale on a grayscale output device, comprising:

means for defining a coarse grid of cells, each coarse cell corresponding to an output device grayscale pixel, and a high-resolution grid of fine cells, the high-resolution grid being aligned with said coarse grid so that each coarse cell includes an integer number of undivided fine cells;

20 means for placing a character defined by a font program with reference to the coarse grid and fine grid, the character having a stem hinted with two parallel edges that is placed with reference to the grids when the character is so placed, the stem hint edges being separated by a stem width; and

25 stem aligner means for processing the stem before rendering the character font program for output on the output device, the stem aligner means comprising means for performing an unbiased-stems hinted stem placement policy.

7. The system of claim 6, wherein:

30 the number of fine cells per coarse cell is determined by a single, client-selected grid ratio.

8. The system of claim 6, wherein:

the number of fine cells per coarse cell is determined according to the number of grayscale levels that can be produced by a pixel of the output device.

9. The system of claim 6, wherein:

5 the stem aligner means further comprises means for performing a black-edge hinted stem placement policy.

10. A method for processing a stem of a character outline, comprising:

selecting a hinted stem placement policy from a set of policies comprising at least either a black-edge policy or an unbiased-stems policy;

10 placing a character defined by a font program with reference to a coarse grid and an overlapping fine grid, the character having a stem hinted with two parallel edges that is placed with reference to the grids when the character is so placed, the stem hint edges being separated by a stem width; and

15 processing the stem before rendering the character font program for output on the output device in accordance with the selected policy.

11. The method of claim 10, further comprising processing the stem in accordance with a black-edge policy by:

rounding the stem width to the width of an integral number of fine cells; and

20 moving the stem with rounded width a minimum distance so that at least one of the stem edges aligns with a parallel coarse cell edge.

12. The method of claim 10, further comprising processing the stem in accordance with a unbiased-stems policy by:

rounding the stem width to the width of an integral number of fine cells;

25 determining a minimum number of coarse cells that can be spanned by the rounded width of the stem; and

determining whether the stem spans more than the minimum number of coarse cells and, if it does, for moving the stem a minimum distance so that at least one of the stem edges aligns with a parallel coarse cell edge.

13. The method of claim 10, wherein the set of policies comprises both a black-edge policy and an unbiased-stems policy.

14. The method of claim 13, wherein the set of policies further comprises a hard-edge policy and a soft-edge policy.

5 15. The method of claim 10, wherein the policy is specifically selected for vertical stems or horizontal stems.

16. The method of claim 10, wherein the policy is selected for both vertical stems and horizontal stems.

17. The method of claim 10, further comprising:
10 selecting a first policy for vertical stems and a different second policy for horizontal stems.

18. A computer program product, tangibly stored on a computer-readable medium, for rendering a character for display in grayscale on a grayscale output device, the product comprising instructions operable to cause a programmable processor to:

15 define a coarse grid of cells, each coarse cell corresponding to an output device grayscale pixel, and a high-resolution grid of fine cells, the high-resolution grid being aligned with said coarse grid so that each coarse cell includes an integer number of undivided fine cells, the grids defining edges of the cells;

place a character defined by a font program with reference to the coarse grid and fine
20 grid, the character having a stem hinted with two parallel edges that are placed with reference to the grids when the character is so placed, the stem hint edges being separated by a stem width; and

perform a black-edge hinted stem placement policy.

19. The product of claim 18, wherein:

25 the number of fine cells per coarse cell is determined according to the number of grayscale levels that can be produced by a pixel of the output device.

20. The product of claim 18, wherein:

the number of fine cells per coarse cell is determined by a single, client-selected grid ratio.

21. The product of claim 18, further comprising instructions to:

5 perform an unbiased-stems hinted stem placement policy.

22. The product of claim 18, wherein:

the instructions to perform a black-edge policy comprise instructions to:

round the stem width to the width of an integral number of fine cells; and

10 move the stem with rounded width a minimum distance so that at least one of the stem hint edges aligns with a parallel coarse cell edge; and

the instructions to perform an unbiased-stems policy comprise instructions to:

round the stem width to the width of an integral number of fine cells;

determine a minimum number of coarse cells that can be spanned by the rounded width of the stem; and

15 determine whether the stem spans more than the minimum number of coarse cells and, if it does, move the stem a minimum distance so that at least one of the stem hint edges aligns with a parallel coarse cell edge.

23. A computer program product, tangibly stored on a computer-readable medium, for rendering a character for display in grayscale on a grayscale output device, the product comprising instructions operable to cause a programmable processor to:

20 define a coarse grid of cells, each coarse cell corresponding to an output device grayscale pixel, and a high-resolution grid of fine cells, the high-resolution grid being aligned with said coarse grid so that each coarse cell includes an integer number of undivided fine cells, the grids defining edges of the cells;

25 place a character defined by a font program with reference to the coarse grid and fine grid, the character having a stem hinted with two parallel edges that are placed with reference to the grids when the character is so placed, the stem hint edges being separated by a stem width; and

perform an unbiased-stems hinted stem placement policy.

24. The product of claim 23, further comprising instructions to:
perform a black-edge hinted stem placement policy.

25. A computer program product, tangibly stored on a computer-readable medium, for processing a stem of a character outline, the product comprising instructions operable to
5 cause a programmable processor to:

select a hinted stem placement policy from a set of policies comprising at least either a black-edge policy or an unbiased-stems policy;

place a character defined by a font program with reference to a coarse grid and an overlapping fine grid, the character having a stem hinted with two parallel edges that is
10 placed with reference to the grids when the character is so placed, the stem hint edges being separated by a stem width; and

process the stem before rendering the character font program for output on the output device in accordance with the selected policy.

26. The product of claim 25, further comprising instructions to:

15 process the stem in accordance with a black-edge policy, including instructions to:
round the stem width to the width of an integral number of fine cells; and
move the stem with rounded width a minimum distance so that at least one of the stem edges aligns with a parallel coarse cell edge.

27. The product of claim 25, further comprising instructions to:

20 process the stem in accordance with a unbiased-stems policy, including instructions to:

round the stem width to the width of an integral number of fine cells;

determine a minimum number of coarse cells that can be spanned by the rounded width of the stem; and

25 determine whether the stem spans more than the minimum number of coarse cells and, if it does, move the stem a minimum distance so that at least one of the stem edges aligns with a parallel coarse cell edge.

28. The product of claim 25, wherein the set of policies comprises both a black-edge policy and an unbiased-stems policy.

29. The product of claim 28, wherein the set of policies further comprises a hard-edge policy and a soft-edge policy.

30. The product of claim 25, wherein the policy is specifically selected for vertical stems or horizontal stems.

5 31. The product of claim 25, wherein the policy is selected for both vertical stems and horizontal stems.

32. The product of claim 25, further comprising:

selecting a first policy for vertical stems and a different second policy for horizontal stems.